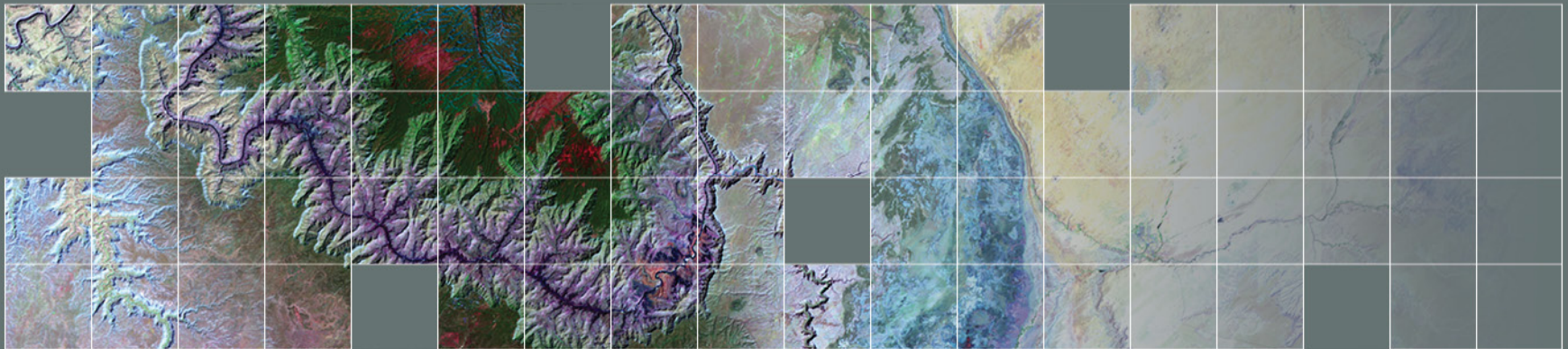


Climate and Land Use Change **Earth Resources Observation and Science (EROS) Center**

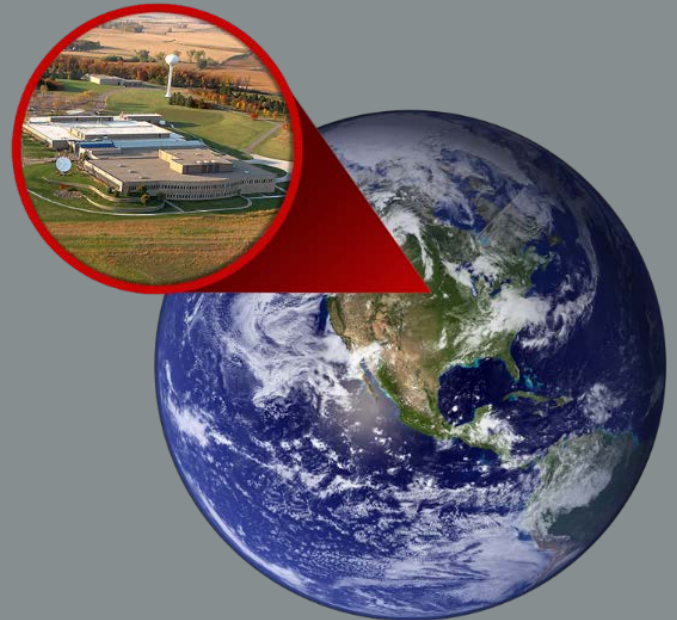
Demystifying MODIS quality data: Determining data usability via quality layers.



Aaron Friesz, Innovate! Inc.
April 11, 2017

NASA's LP DAAC

- Land Processes (LP) Distributed Active Archive Center (DAAC)
 - <https://lpdaac.usgs.gov>
- Located in Sioux Falls, SD at the USGS Earth Resources Observation Science (EROS) Center
- 1 of 12 NASA Earth Observing System Data and Information System (EOSDIS) DAACs
- Part of in NASA's Earth Science Data Systems Program



More than an archive

Data

- MODIS
- ASTER
- MEaSURES
- Community Products

Tools/Services

- AppEEARS
- Daac2Disk
- AppEEARS Services/API
- OPeNDAP

Tutorials/Scripts

- Video Tips
- How-to Jupyter Notebooks
- Data processing scripts

MODIS Collection

- Moderate Resolution Imaging Spectroradiometer
- Largest Collection
 - Version 5.x
 - Version 6.0
- Terra, Aqua, and Combined products

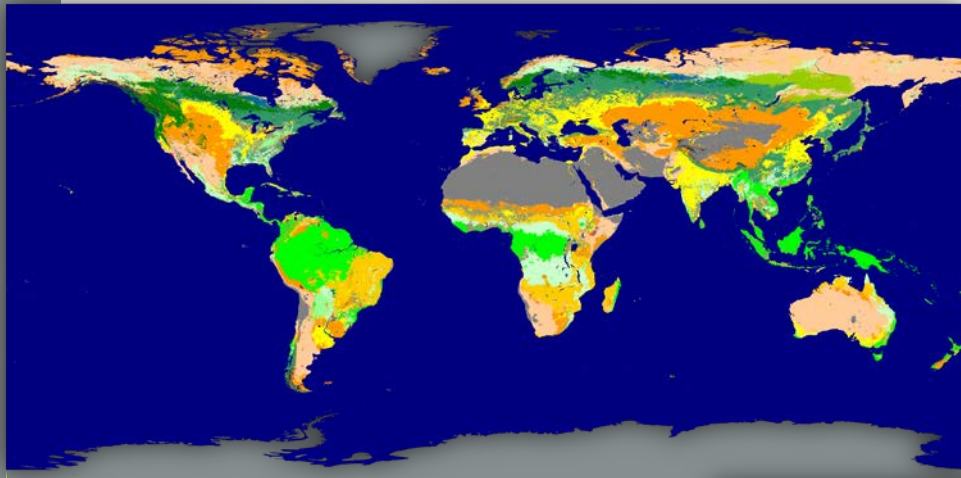


MOD09Q1.A2000241.h10v04.006 True Color
R = band 1; G = band 4; B = band 3

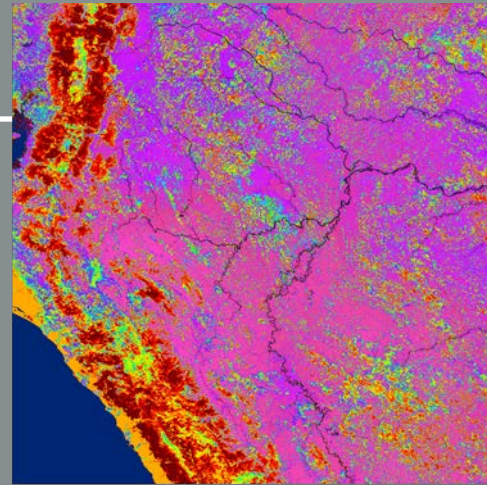
MODIS Specs

Versions	<ul style="list-style-type: none">• v5.x• v6.0
Spatial Coverage	<ul style="list-style-type: none">• Global: <i>CMG, Tiled</i>
Temporal Coverage	<ul style="list-style-type: none">• Terra: 2000-Present• Aqua: 2002-Present
Spatial Resolution	<ul style="list-style-type: none">• 250m, 500m, 1000, 5600m
Temporal Resolution	<ul style="list-style-type: none">• Daily, 8-day, 16-day, Monthly, Annual
Unique Products	<ul style="list-style-type: none">• v5.x:• v6.0: 126 and growing!

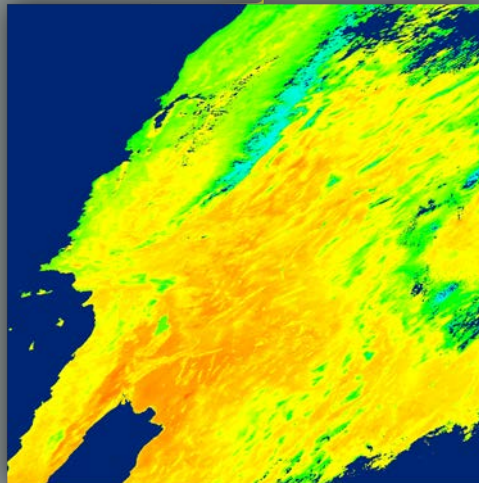
MODIS



MCD12C1.A2012001.051.2013178154403.hdf - Land_Cover_Type_1 (IGBP)



MYD17A2H.A2017073.h10v09.006.2017082132329.hdf - GPP



MOD11A2.A2017081.h08v05.006.2017090162451.hdf - LST Day

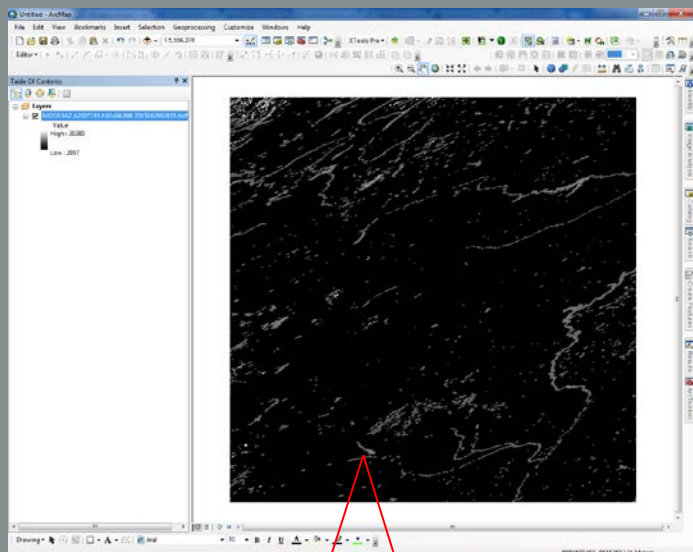


MOD13A1.A2017065.h10v08.006.2017082120511.hdf - NDVI

Using Quality Data

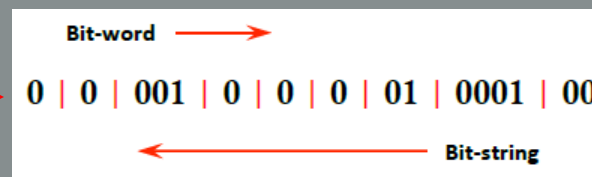
- **Data products include quality assurance (QA)**
 - Usability and usefulness of the data product
- **All MODIS products contain a QA layer**
 - Granule-level QA Stats
 - QA Flags
 - Pixel-level QA
- **Often overlook**
 - Difficult to decode
 - Tedious to interpret

Decoding MODIS QA



Pixel value: **2116**

16-bit binary value: 0000100001000100



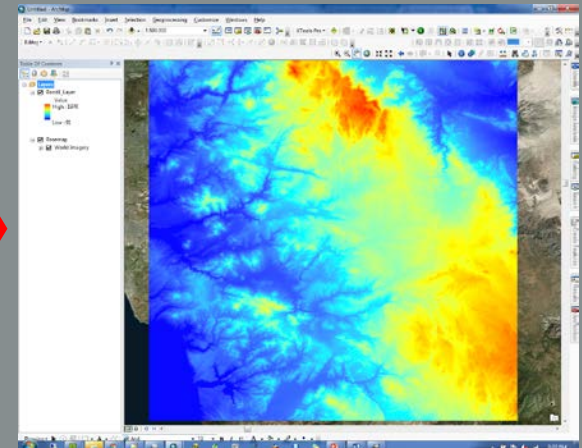
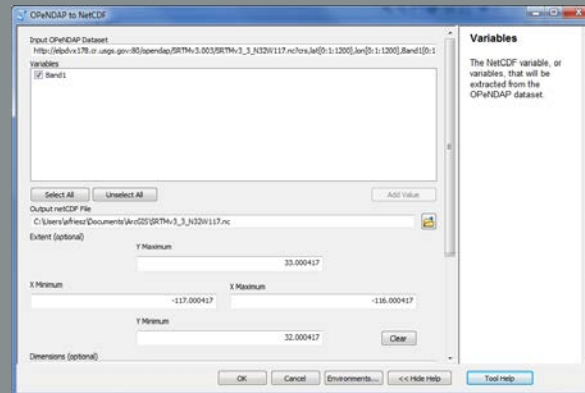
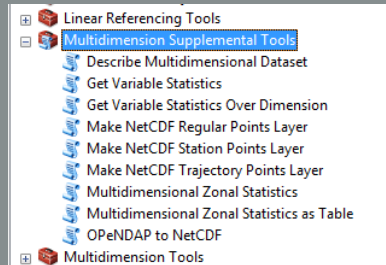
VI Quality = 00, pixel produced with good quality
VI usefulness = 0001, pixel is of highest quality
Aerosol Quantity = 01, aerosol load was low
Adjacent Cloud detected = 0, no adjacent clouds detected
Atmospheric BRDF Correction = 0, no Atmosphere BRDD correction performed
Mixed Clouds = 0, pixel with no mixed clouds
Land Water Mask = 001, pixel over land
Possible Snow/Ice = 0, no snow/ice cover
Possible Shadow = 0, no cloud shadow

Quality Web Service

<https://lpdaacsvc.cr.usgs.gov/services/appeears-api/quality?help=html>

ArcGIS Python Toolbox

- Geoprocessing toolboxes that are created entirely in Python
- Look, act, and work just like toolboxes and tools created in any other way



Decoding MODIS QA

**ArcGIS Python
Toolbox**



**Python Toolbox
with quality
decoding script**

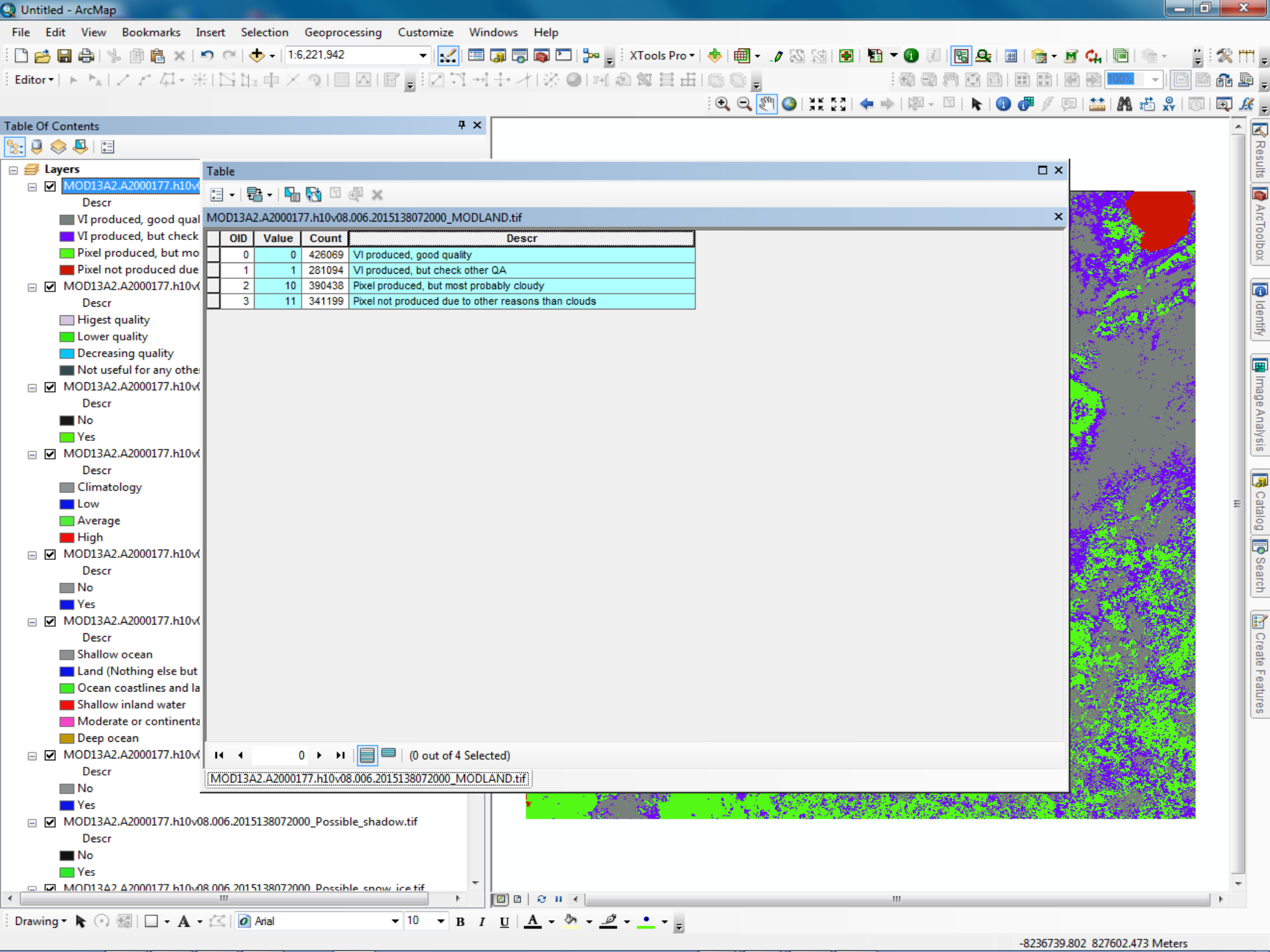


 *Quality Decoder*

**LP DAAC Web
Services**



*AppEEARS
Quality Service*



A satellite map of South America, focusing on the Amazon basin. The Amazon River and its tributaries are visible, flowing through the dense green forest. The surrounding land is a mix of green and brown, indicating different vegetation types and possibly deforestation. The ocean is visible to the west and south.

Amazon Forest Green-Up During 2005 Drought

- Used MODIS EVI
 - 2000-2006
- “Properly filtered to remove atmospheric aerosol and cloud effects”
- Forest greenness increased during the 2005 drought

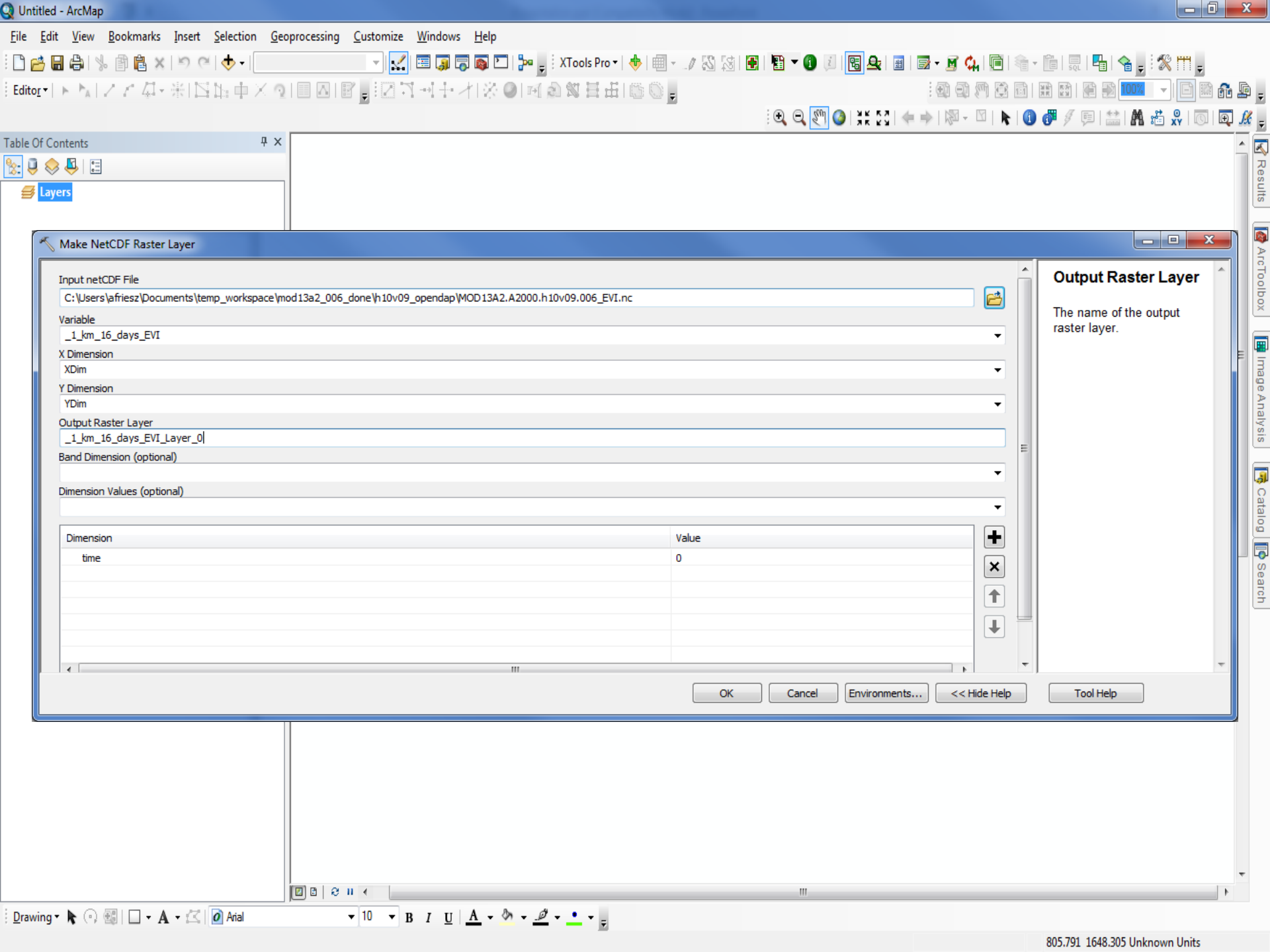
Saleska, S. R., K. Didan, A. R. Huete, and H. R. da Rocha. 2007. Amazon forest green-up during 2005 drought, *Science*, 318(5850), 612

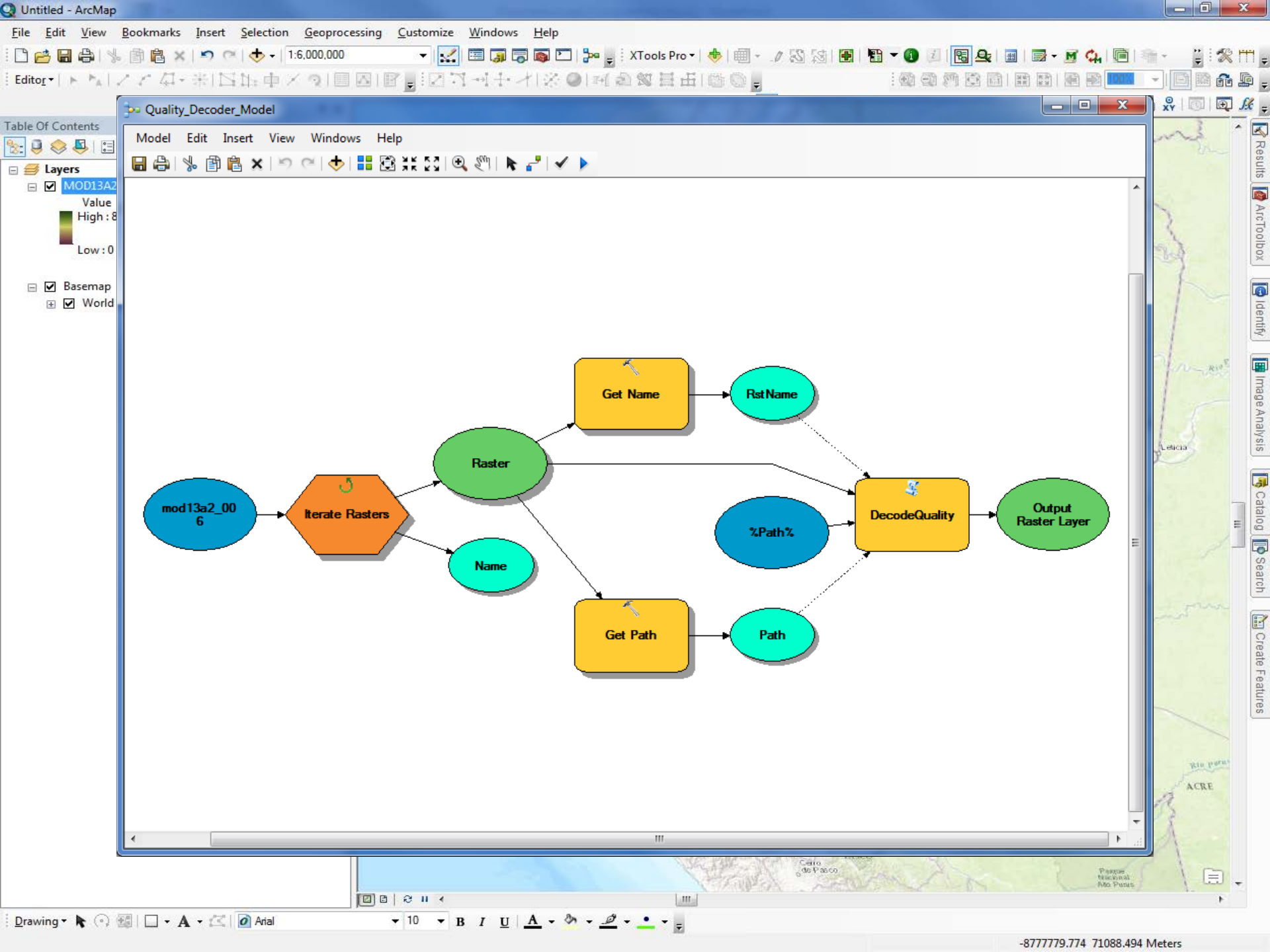


Amazon Forest did not Green-Up During the 2005 Drought

- Not able to replicate results
- Demonstrated that the data was not properly filtered for quality
- No increase in forest greenness during the 2005 drought

Samanta, A., S. Ganguly, H. Hashimoto, S. Devadiga, E. Vermote, Y. Knyazikhin, R. Nemani, and R. Myneni. 2010. Amazon forest did not green-up during 2005 drought. *Geophysical Research Letters*, 37, L05401





Untitled - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:6,000,000

Editor

Table Of Contents

Layers

MOD13A2_A2004193.h10v09.006.2015154131744 EVI.tif

Quality_Decoder_Model

Model Edit Insert View Windows Help

mod13a2_006

Iterate Rasters

Raster

Name

Get Name

RstName

Get Path

Path

%Path%

DecodeQuality

Output Raster Layer

DecodeQuality

Input Raster Layer

Output Workspace

Output Raster Layer Name

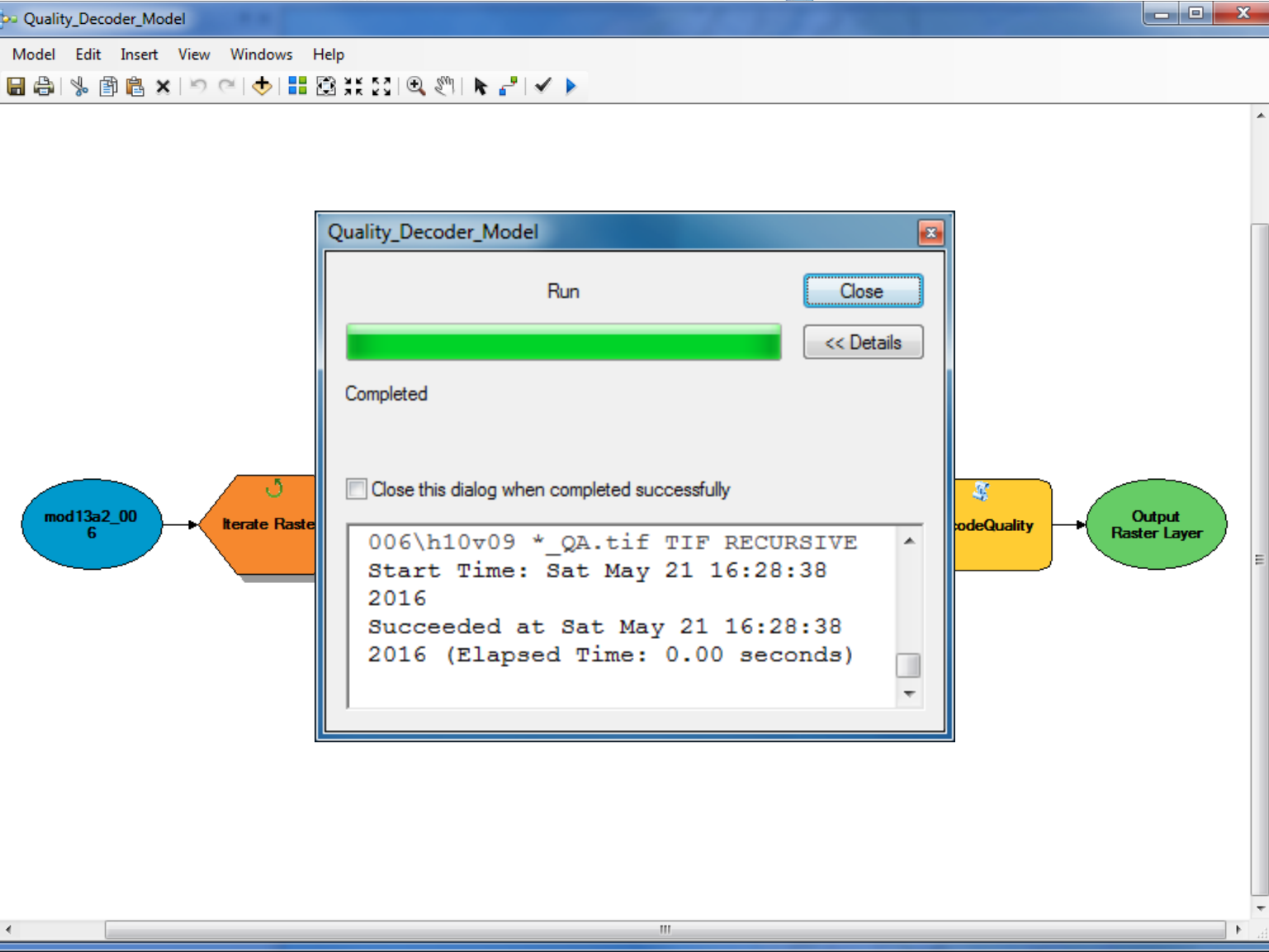
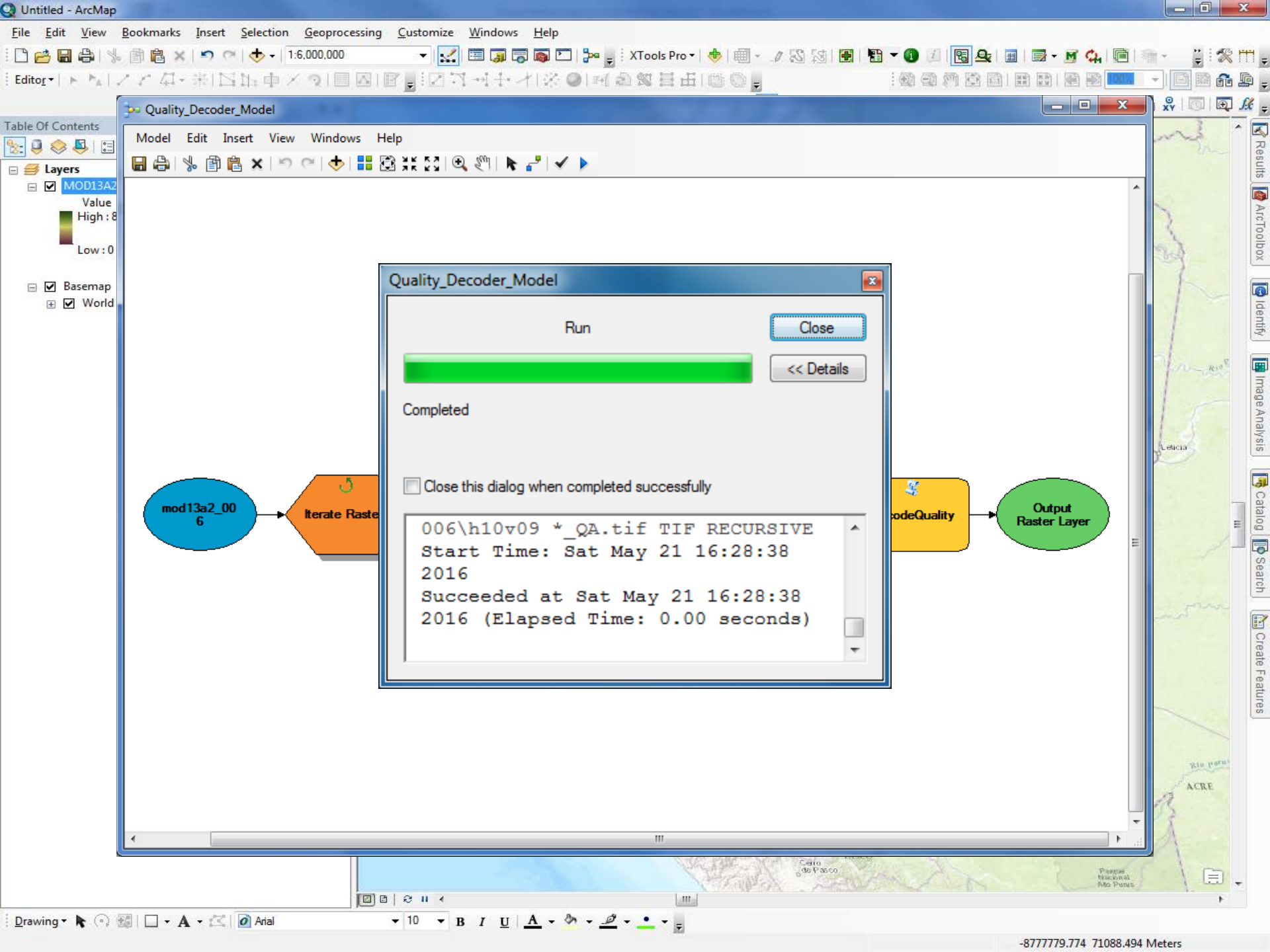
Product
MOD13A2.006

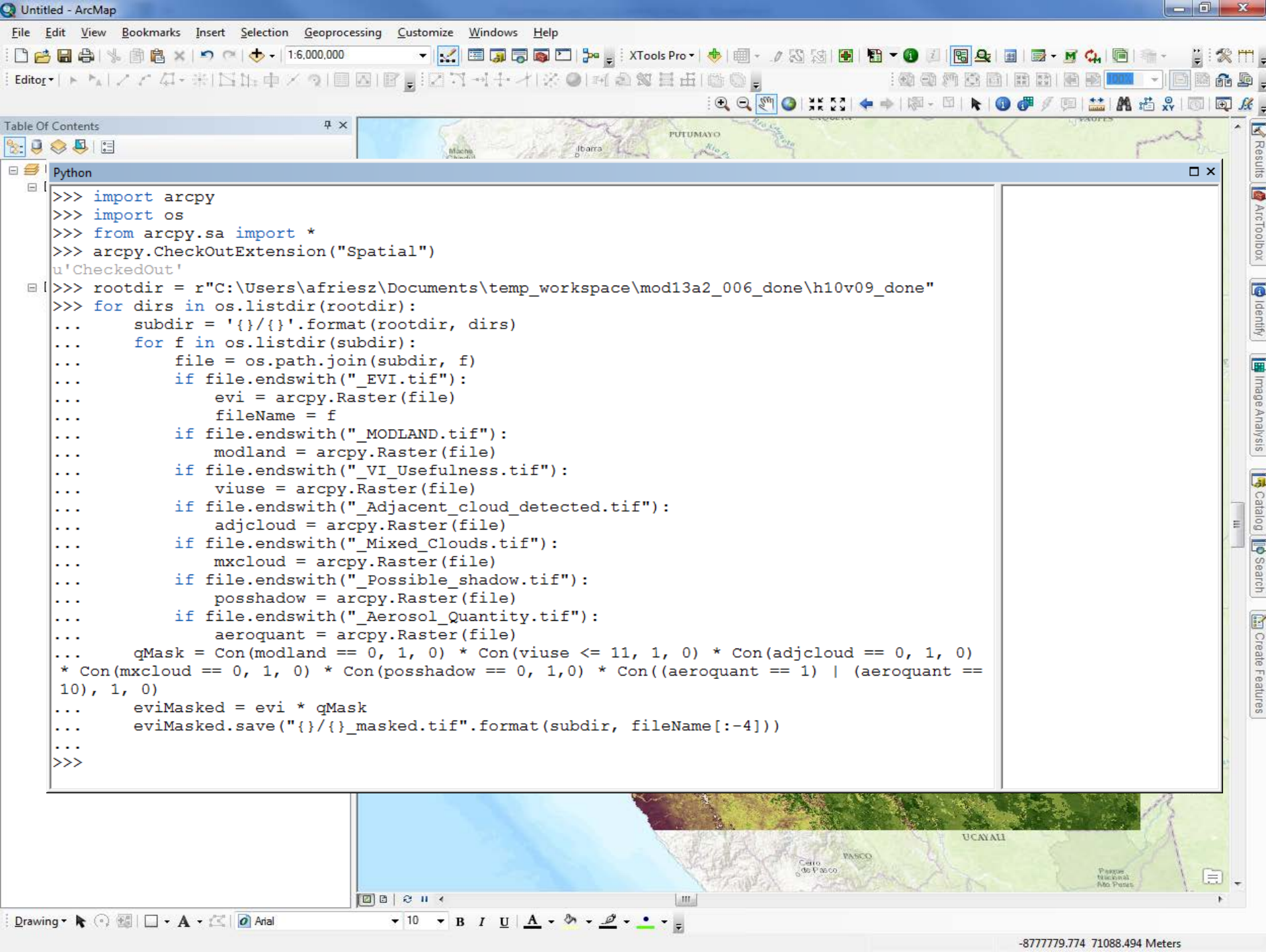
Quality Layer
_1km_16_days_VI_Quality

Bit-Field (optional)
ALL

OK Cancel Environments... << Hide Help Tool Help

7779.774 71088.494 Meters





Unscreened

